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PUMP COMPRISING A SHIELD VALVE CONTROLLED BY THE CONVEYING MEDIUM

The invention relates to a pump with at least one shield valve controlled by the conveyed medium, and having a valve disk of flexible material which is clamped in a central region and is movable between an open position and a closed position, in which closed position the valve shield closes at least one valve opening.

From DE 42 00 838 A1 a diaphragm pump is already known, the inlet and outlet valves of which are respectively formed as a shield valve controlled by the conveyed medium. Each of these shield valves has a valve disk of flexible material which is clamped in the central region and is movable between an open position and a closed position. While the valve disk in its closed position closes at least one valve opening, in its open position it abuts at least locally on a valve abutment surface arranged on a side remote from the valve opening.

Due to the opening and closing movements of the valve disk, this valve disk can also fit flat against the valve abutment surface and suddenly expel the air present between the valve disk and the valve abutment surface, whereby an annoying noise arises.

The object therefore in particular exists of providing a pump equipped with at least one shield valve of the type mentioned above, which is distinguished by a comparatively low noise development.

The solution of this object according to the invention is provided for the known type of pump, particularly in that extensions project from the valve disk and/or on a valve abutment surface arranged on its side remote

from the valve opening, to prevent a sudden flat abutment of the valve disk on the valve abutment surface and/or for limiting the valve opening movement.

The pump according to the invention has at least one shield valve, in which extensions project from the valve disk and/or on the valve abutment surface. A valve abutment surface is arranged to prevent a sudden flat abutment of the valve disk on a side arranged toward the valve opening. Since extensions are provided on the valve disk and/or on the valve abutment surface, a sudden abutment of the valve disk on the valve abutment surface is prevented, and the air present between the valve disk and the valve abutment surface can escape without an annoying slapping sound being expected in the region of this shield valve.

A preferred embodiment according to the invention provides that the extensions provided on the valve disk project in step shape beyond the peripheral edge of the disk of the valve disk and act on the region of the shield valve surrounding the valve abutment surface. Due to the step-shaped extensions on the disk periphery of the valve disk, the valve disk abuts on the valve abutment surface at most in a wave form, so that a sudden impact of the valve disk on the valve abutment surface, and thus an annoying noise development, is prevented.

In order to prevent a loud impact of the valve disk over the whole disk periphery, it is advantageous if the valve disk has a plurality of extensions projecting approximately uniformly over the peripheral edge of the disk.

So that the valve abutment surface can flatten the valve disk out into its disk shape corresponding to the open position, it is appropriate if the valve abutment surface is generally cone-shaped.

A preferred embodiment according to the invention provides that the central region of the valve disk is centered by means of a pin which passes through a central perforation of the valve disk.

A further development according to the invention, of importance worthy of its own protection, provides that the valve disk is connected by at least one of the step-shaped extensions with a sealing ring surrounding the valve disk and sealingly clamped between two housing portions. This embodiment according to the invention offers the advantage that an inadvertent rotation of the valve disk during the opening and closing motions is avoided and a corresponding wear on the valve disk is prevented. Furthermore, an additional, separate sealing ring can be omitted which otherwise seals the valve opening between an intermediate cover and a pump head cover. Finally, a certain prestress is produced on these step-shaped extensions by the extensions connecting the sealing ring and the valve disk, and slows the opening of the valve disk and reduces the path of opening, avoids a sudden escape of the air located between the valve disk and the valve abutment surface, and additionally opposes an annoying development of noise.

A preferred embodiment according to the invention, which does not excessively prevent the opening movement of the valve disk, provides that the at least one extension connecting the valve disk and the sealing ring runs at least sectionally transversely of the disk radius, and in particular runs in a spiral shape.

It is particularly advantageous if at least one gap acting as a passage opening is provided between the sealing ring and the valve disk.

Further features of the invention will become apparent from the following description of an embodiment example according to the invention in connection with the claims and the accompanying drawing.

Figure 1 shows a diaphragm pump in longitudinal section, the inlet and outlet valves of which are formed as shield valves,

Figure 2 shows an inlet valve of the diaphragm pump shown in Figure 1, in its closed position,

Figure 3 shows the inlet valve of Figure 2 in its open position,

Figure 4 shows the valve disk of the shield valve shown in Figures 2 and 3, in a plan view,

Figure 5 shows a shield valve whose valve disk has a shape altered from that of Figures 2 and 3, the shield valve being shown in its closed position,

Figure 6 shows the shield valve of Figure 5 in its open position, in which the valve disk is at least approximately on a valve abutment surface, and

Figure 7 shows the valve disk of the shield valve shown in Figures 5 and 6, in a plan view.

A diaphragm pump 1 is shown in Figure 1, with its inlet valve 2 and its outlet valve 3 being respectively embodied as shield valves. The shield valves 2, 3 of the diaphragm pump 1 shown in Figure 1 have a valve disk 4 controlled by the conveyed medium and clamped in a central region between a pump head cover 5 and an intermediate cover 6, and centered by means of a pin 7 which passes through a central perforation 8 of the valve disk 4.

The valve disk 4 of the shield valves 2, 3 is movable between a closed and an open position. While the valve disk 4 in its closed position closes at least one valve opening 9, it moves during its opening motion in the direction toward a valve abutment surface 10.

In order to limit the valve opening motion of the valve disk 4 of the shield valves shown in Figs 1-4, and in order to prevent a sudden flat abutment of the valve disk 4 on the valve abutment surface 10, which otherwise would be associated with an annoying noise production, extensions 11 which project in step form beyond the peripheral edge of the disk of the valve disk 4 are provided on the valve disks 4 of the shield valves, as shown in more detail in Figures 1-4 on the one hand and in Figures 5-7 on the other hand.

It can be seen from Figures 5 and 6 that the extensions 11 provided on the valve disk 4 of this shield valve act on the region 12 surrounding the valve abutment surface 10 such that a first contact between the extensions 11 and the valve abutment surface 10 takes place during the opening motion of the shield valve, before the abutment of the valve disk 4 on the valve abutment surface 10. Thus the air located between the valve disk 4 and the valve abutment surface 10 can escape. Since the valve disk 4 thereby makes a wave-form opening motion, a slapping abutment of the valve disk on the valve abutment surface 10, with an associated annoying noise, is prevented.

It can be seen from Figures 5 and 6 that the valve abutment surface 10 is of conical shape and thus substantially matches the shape of the valve disk 4 in the open position.

It can be gathered from Figures 1-4 that the valve disk 4 of the shield valves shown there has step-shaped extensions 11 which connect together the valve disk 4 on the one hand and the sealing ring 13 surrounding the valve disk 4 on the other hand. This sealing ring 13 is clamped between the pump head cover 5 and the intermediate cover 6 and seals the shield valve in the parting plane lying therebetween.

It is clear from the plan view in Figure 4 that the extensions 11 connecting together the valve disk 4 and the sealing ring 13 are at least sectionally transverse of the disk radius and in particular are of spiral form. These extensions prevent a rotary motion of the valve disk 4 around the pin 7 and hence a corresponding wear, and limit – as can well be seen in Figure 3 – the valve opening motion such that a noisy sudden abutment of the valve disk 4 on the valve abutment surface 10 is prevented with certainty.

It is to be gathered from Figure 4 that at least one gap 14 acting as a passage opening is provided between the sealing ring 12 and the valve disk 4.

A pump equipped with the shield valves shown in Figures 1-7 is distinguished by a particularly low-noise operation.